CLAIMS

What is claimed is:

1. A method of controlling a vacuum cleaner, the method including the steps of:

a) detecting a differential pressure between a suction airflow path associated with the vacuum cleaner and ambient air near the vacuum cleaner;

b) comparing the detected differential pressure to a first predetermined threshold;

c) initiating a first predetermined control procedure when the detected differential pressure is less than the first predetermined threshold; and

d) updating a status indicator based on the detected differential pressure.

2. The method as set forth in claim 1, between steps c) and d), further including:

e) comparing the detected differential pressure to a second predetermined threshold when the detected differential pressure is not less than the first predetermined threshold; and

f) initiating a second predetermined control procedure when the detected differential pressure is less than the second predetermined threshold.

3. The method as set forth in claim 2, between steps e) and d), further including the steps:

g) comparing the detected differential pressure to a third predetermined threshold when the detected differential pressure is not less than the second predetermined threshold; and

h) initiating a third predetermined control procedure when the detected differential pressure is less than the third predetermined threshold.

4. The method as set forth in claim 3, before step b), further including the step of:

setting the first predetermined threshold to a value associated with a maximum differential pressure when the suction airflow path is obstructed by a foreign object.

5. The method as set forth in claim 4, before step e), further including the step of:

setting the second predetermined threshold to a value associated with a maximum differential pressure when the suction airflow path is obstructed because a dirt receptacle associated with the vacuum cleaner is generally full.

6. The method as set forth in claim 5, before step g), further including the step of:

setting the third predetermined threshold to a value associated with a maximum differential pressure when the suction airflow path is obstructed because a filter associated with the vacuum cleaner is generally blocked.

7. The method as set forth in claim 3, the first predetermined control procedure in step c) further including the step of:

stopping a suction motor associated with the suction airflow path.

8. The method as set forth in claim 7, the first predetermined control procedure in step c) further including the step of:

stopping a brush motor associated with the vacuum cleaner.

9. The method as set forth in claim 8, the first predetermined control procedure in step c) further including the step of:

stopping a drive motor associated with propulsion of the vacuum cleaner.

10. The method as set forth in claim 1, step d) further including the step of:

illuminating a display sequence corresponding to the detected differential pressure.

11. The method as set forth in claim 1, step d) further including the step of:

annunciating an audible tone sequence corresponding to the detected differential pressure.

12. A method of controlling a vacuum cleaner, the method including the steps of:

a) monitoring a brush motor feedback signal relating to operation of a corresponding brush motor brush motor associated with the vacuum cleaner;

b) comparing the feedback signal to a predetermined threshold;

c) removing power from the brush motor and disabling operation of the brush motor until power is manually reset when the feedback signal is less than the predetermined threshold; and

d) repeating steps a) - c) when the feedback signal is not less than the predetermined threshold.

13. The method as set forth in claim 12, before step b), further including the step of:

setting the predetermined threshold based on a correlation between the feedback signal and a minimum electrical current causing an over current condition in the brush motor.

14. The method as set forth in claim 12 wherein the feedback signal provides information associated with one or more of a brush motor RPM, a brush motor torque, a quantity of brush motor revolutions, and a distance of brush motor rotation.

15. A method of controlling a vacuum cleaner, the method including the steps of:

a) detecting a level of electrical current flowing through a brush motor associated with the vacuum cleaner;

b) comparing the detected brush motor current to a predetermined threshold;

c) removing power from the brush motor and disabling operation of the brush motor until power is manually reset when the detected brush motor current is greater than the predetermined threshold; and

d) repeating steps a) - c) when the detected brush motor current is not greater than the predetermined threshold.

16. The method as set forth in claim 15, before step b), further including the step of:

setting the predetermined threshold based on a minimum electrical current causing an over current condition in the brush motor.

17. A method of controlling a vacuum cleaner, the method including the steps of:

a) emitting sonic energy toward a floor being traversed by the vacuum cleaner;

b) detecting sonic energy reflected by the floor;

c) comparing the detected sonic energy to a predetermined threshold;

d) initiating a first predetermined control procedure when the detected sonic energy exceeds the predetermined threshold;

e) initiating a second predetermined control procedure when the detected sonic energy does not exceed the predetermined threshold; and

f) repeating steps a) - e).

18. The method as set forth in claim 17, the first predetermined control procedure in step d) further including the step of:

stopping a brush motor associated with the vacuum cleaner.

19. The method as set forth in claim 17, the second predetermined control procedure in step e) further including the step of:

operating the brush motor.

20. A method of controlling a vacuum cleaner, the method including the steps of:

a) emitting sonic energy toward a floor being traversed by the vacuum cleaner;

b) detecting the sonic energy reflected by the floor;

c) comparing the detected sonic energy to at least one of a plurality of values in a lookup table (LUT), wherein each LUT value represents at least one of a type and a condition of a floor;

d) determining at least one of the type and condition of the floor being traversed by matching the detected sonic energy to an LUT value; and

e) initiating a predetermined control procedure based on the type of floor being traversed.

21. The method as set forth in claim 20, further including the steps of:

f) periodically repeating steps a) through d) while power is applied to the vacuum cleaner; and

g) repeating step e) when at least one of the type and condition of the floor being traversed is different for successive passes through steps a) through d).

22. The method as set forth in claim 20, the predetermined control procedure in step d) further including the step of:

adjusting a speed of a brush motor associated with the vacuum cleaner to a preferred speed for at least one of the type and condition of the floor being traversed.

23. The method as set forth in claim 20 wherein the vacuum cleaner is a carpet extractor, the predetermined control procedure in step d) further including the steps:

selecting a preferred cleaning solution based on at least one of the type and condition of the floor being traversed; and

dispensing a preferred quantity of the selected cleaning solution based on at least one of the type and condition of the floor being traversed.

24. A method of controlling a self-propelled vacuum cleaner, the method including the steps of:

a) emitting light energy toward a floor over which the vacuum cleaner is advancing;

b) detecting the light energy reflected by the floor;

c) comparing the detected light energy to a predetermined threshold to determine a distance to a surface of the floor;

d) initiating a predetermined control procedure when the detected light energy is less than the predetermined threshold; and

e) periodically repeating steps a) through d) while the vacuum cleaner is being propelled.

25. The method as set forth in claim 24, before step c), further including the step of:

setting the predetermined threshold to a value associated with a minimum distance to the surface of the floor that suitably permits the vacuum cleaner to continue advancing over the floor.

26. The method as set forth in claim 24, the predetermined control procedure in step d) further including the step of:

stopping a drive motor associated with propulsion of the vacuum cleaner.

27. The method as set forth in claim 26, the predetermined control procedure in step d) further including the step of:

reversing the drive motor associated with propulsion of the vacuum cleaner.

28. The method as set forth in claim 27, the predetermined control procedure in step d) further including the step of:

activating a localization function associated with the self-propelled vacuum cleaner.

29. The method as set forth in claim 28, the predetermined control procedure in step d) further including the step of:

controlling the drive motor to maneuver the vacuum cleaner to avoid a surface condition where the distance to the surface of the floor associated with the detected light energy is not suitable for the vacuum cleaner to continue advancing.

30. A vacuum cleaner (10), including:

a housing;

a suction airflow sensor (94), disposed within said housing, for detecting a condition associated with a suction airflow path mounted to the housing;

a sensor processor (90), disposed within said housing, in communication with the suction airflow sensor for evaluating the detected condition, determining whether a responsive action is required, and, when required, initiating a suitable predetermined control procedure in response to the detected condition;

a vacuum source (36, 38), disposed within said housing, for creating the suction airflow path to provide a vacuuming function for collection of dust and dirt particles; and

a controller processor (74), disposed within said housing, in communication with the sensor processor for selectively controlling the vacuum source;

wherein the suction airflow sensor includes a differential pressure sensor for detecting a difference between a first pressure associated with the suction airflow path and a second pressure associated with ambient air near the vacuum cleaner.

31. The vacuum cleaner as set forth in claim 30, the sensor processor comprising:

means for determining whether the first pressure in the suction airflow path is suitable for normal vacuuming operations based on information provided by the sensor; and

a status indicator (164) for indicating whether the vacuum cleaner is able to perform normal vacuuming operations.

32. The vacuum cleaner as set forth in claim 31, the sensor processor comprising:

means for determining whether the suction airflow path is obstructed by a foreign object;

wherein, if the suction airflow path is obstructed by a foreign object, the sensor processor causes the suction motor to stop and updates the status indicator.

33. The vacuum cleaner as set forth in claim 31, the sensor processor comprising:

means for determining whether a dirt receptacle associated with the vacuum cleaner is generally full;

wherein, if the dirt receptacle is generally full, the sensor processor performs a predetermined control procedure and updates the status indicator.

34. The vacuum cleaner as set forth in claim 31, the sensor processor comprising:

means for determining whether a filter associated with the vacuum cleaner is generally blocked,

wherein, if the filter is generally blocked, the sensor processor performs a predetermined control procedure and updates the status indicator.

35. The vacuum cleaner as set forth in claim 31 wherein the status indicator includes an illuminated indicator having at least four illuminated display sequences.

36. The vacuum cleaner as set forth in claim 31 wherein the status indicator includes an annunciator having a plurality of audible tone sequences.

37. The vacuum cleaner as set forth in claim 30 wherein the vacuum cleaner is a type selected from the group consisting of a robotic vacuum cleaner, a robotic canister-like vacuum cleaner, a hand vacuum cleaner, a carpet extractor, a canister vacuum cleaner, a stick vacuum cleaner, an upright vacuum cleaner, and a shop-type vacuum cleaner.

38. The vacuum cleaner as set forth in claim 30, the vacuum cleaner further including:

a movable brush (54) mounted to the housing;

a brush motor (100), disposed within said housing, in operative communication with said brush to operate said brush; and

a brush motor controller (134) in operative communication with the controller processor and the brush motor to selectively operate said brush motor and brush to assist in collection of dust and dirt particles.

39. The vacuum cleaner as set forth in claim 38, the vacuum cleaner further including:

an overcurrent sensor (98), disposed within said housing, in communication with the sensor processor and the brush motor for monitoring a characteristic of the brush motor and providing an associated feedback signal to the sensor processor; and

a reset switch (140), disposed within said housing, in operative communication with the sensor processor and the brush motor controller for manually

resetting power applied to the brush motor and providing a reset switch activation signal to the sensor processor;

wherein the sensor processor compares the feedback signal to a predetermined threshold and, when the feedback signal is less than the predetermined threshold, removes power from the brush motor and disables operation of the brush until power is manually reset.

40. The vacuum cleaner as set forth in claim 39, the overcurrent sensor including:

an overcurrent feedback module (135) in operative communication with the sensor processor and the brush motor for monitoring the brush motor characteristic and providing the feedback signal to the sensor processor.

41. The vacuum cleaner as set forth in claim 39 wherein the brush motor characteristic associated with the feedback signal includes one or more of a brush motor RPM, a brush motor torque, a quantity of brush motor revolutions, and a distance of brush motor rotation.

42. The vacuum cleaner as set forth in claim 38, the vacuum cleaner further including:

an overcurrent sensor (98), disposed within said housing, in communication with the sensor processor and the brush motor for detecting a level of electrical current flowing through the brush motor; and

a reset switch (140), disposed within said housing, in operative communication with the sensor processor and the brush motor controller for manually resetting power applied to the brush motor and providing a reset switch activation signal to the sensor processor;

wherein the sensor processor compares the detected current to a predetermined threshold and, when the detected current exceeds the predetermined threshold, removes power from the brush motor and disables operation of the brush until power is manually reset.

43. The vacuum cleaner as set forth in claim 42, the overcurrent sensor including:

an electronic switch (138) in operative communication with the sensor processor and the brush motor for enabling and disabling operation of the brush motor; and

a current sense circuit (136) in operative communication with the sensor processor and the brush motor for sensing the level of electrical current flowing through the brush motor.

44. The vacuum cleaner as set forth in claim 38, the vacuum cleaner further including:

a floor type sensor (97), disposed within said housing, in operative communication with the sensor processor for emitting sonic energy toward a floor being traversed by the vacuum cleaner and detecting sonic energy reflected by the floor;

wherein the sensor processor compares the detected sonic energy to a plurality of values in a lookup table (LUT), wherein the LUT values represent a plurality of types of floors, matching the detected sonic energy to a LUT value to determine the type of floor being traversed, and initiating a predetermined control procedure based on the type of floor being traversed.

45. The vacuum cleaner as set forth in claim 44, the vacuum cleaner further including:

a signal generator circuit (124), disposed within said housing, in communication with the sensor processor and the floor type sensor for generating a signal associated with the sonic energy emitted by the floor type sensor;

a signal conditioning circuit (130), disposed within said housing, in communication with the floor type sensor for conditioning a signal associated with the sonic energy detected by the floor type sensor; and

a comparator processor (132), disposed within said housing, in communication with the signal conditioning circuit and the sensor processor for comparing the conditioned signal to the LUT values.

46. The vacuum cleaner as set forth in claim 30, the vacuum cleaner further including:

a floor distance sensor (96), disposed within said housing, in operative communication with the sensor processor for emitting light energy toward a surface of a floor toward which the vacuum cleaner is advancing and detecting light energy reflected by the floor; and

a drive motor (104), disposed within said housing, in operative communication with the controller processor to selectively operate a drive wheel (50) to propel the vacuum cleaner;

wherein the sensor processor compares the detected light energy to a predetermined threshold and, when the detected light energy is less than the predetermined threshold, stops the drive motor.

47. The vacuum cleaner as set forth in claim 46, the vacuum cleaner further including:

a signal conditioning circuit (146), disposed within said housing, in communication with the floor distance sensor and the sensor processor for conditioning a signal associated with the light energy detected by the floor distance type sensor.

48. The vacuum cleaner as set forth in claim 46 wherein, when the detected light energy is less than the predetermined threshold, the sensor processor reverses the drive motor and activates a localization function associated with the vacuum cleaner.